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Program

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Expected Accomplishments from CANUSA

Note: Mel McKnight presented the following talk at the Northeastern Forest Pest Council meeting March 9, 1983, in Portland, Maine.

We are pleased to have this opportunity to summarize for you the expected accomplishments from the CANUSA Program. Because the invitation was extended to the Program Leaders' offices in Ottawa and Washington, we assume that you expect a general overview, that is, some information on the western components of the Program. However, because we are reporting to the Northeastern Forest Pest Council, we will focus on products from the Program in the Eastern United States and Canada.

To be certain that I give proper credit to the accomplishments of the eastern components of the Program, Bob Talerico, Research Coordinator for CANUSA-East, is joining me in this presentation. I will deal with generalities; Bob will answer your specific questions. Also, we acknowledge that Bob Taylor, Assistant Program Leader in Ottawa, has provided information on the Canadian Program.

Before we talk about accomplishments, let us put some sideboards on our presentation. We will *not* "report on integrated pest management systems that CANUSA has developed" (even though this is the topic suggested by your Program Chairman). We cannot claim accomplishments in this context; this was not an objective of the CANUSA Program. The charter for the U.S. element of the CANUSA Program directs us to "provide forest managers with capability to develop and implement integrated pest management systems to protect forest resources, and to minimize environmental impacts of protection efforts." You will note that we consider the responsibility for "integration" to be with you folks — the forest managers and pest management specialists. A review of the collective accomplishments of the Program will show that we are meeting our objectives of providing you with information you need.

The following are some of the joint projects involving the U.S. and Canadian elements of the Program. These projects probably would not have been carried out without the opportunities provided by the formal agreement to coordinate and cooperate.

1. B.t. projects
2. Models of defoliation effects on growth and yield
3. Budworm population dynamics models (West)
4. Sex pheromones for monitoring populations
5. Sex pheromones for control (East)
6. Joint registration of insecticides
7. Inventory of all studies in both countries
8. Bibliography of worldwide literature
9. Technology transfer projects

The following is the list of accomplishments we expect from the CANUSA Program, both eastern (E) and western (W) components:

- E,W Resource managers to be provided information and technology to apply in pest management systems
- E,W Use of attractants for earlier detection of developing outbreaks
- E,W Improved sampling systems for monitoring and evaluating budworm populations (eggs, larvae, pupae)
- E,W Realistic appraisal of impacts of outbreaks
- E Salvage guides for utilization of threatened or damaged stands
- E Market opportunities for salvaged balsam fir
- E,W Evaluation of *Bacillus thuringiensis* (B.t.)
- W Tests of implanted insecticides for protecting high-value trees and stands
- E,W Stand hazard-rating systems
- W Regional climatic hazard rating (western)
- E,W Growth/yield/mortality predictions
- E,W Silvicultural prescriptions
- E,W Management guidelines for conservation and augmentation of natural enemies
- E,W Simulation models of budworm and stand development for forest planners and managers
- E,W Treatment decision guides for resource managers
- E,W Demonstration areas in Maine, Lake States, Montana, Idaho, and New Mexico for technology transfer

Here we have indicated that some efforts are mainly eastern and some mainly western because managers in the East and the West have different needs. However, you will note that the eastern and western components have both made useful contributions in most of the areas. At this point we will focus our attention on a few of the items in the list, items of special interest in Eastern United States and Canada.

One of the joint projects involving both U.S. and Canadian elements is population monitoring using pheromone-baited traps to capture male spruce budworm moths. The long-term objective is to provide managers with the capability to develop and deploy an early warning system that will alert forest and pest managers to building budworm populations. By detecting the incidence of budworm early, managers will have time to consider and implement alternatives that would not be possible otherwise.

Right now this system employs components that are not quite off-the-shelf items, but the details of each are specific enough so that availability will not be a problem. Cooperators for this project range from

the Canadian Maritimes to the Lake States. The field effort has been aimed at developing efficient trap placement, evaluation of commercial lures, and interpretation of trap catch data. By the end of 1984, guidelines will be available for managers to implement a monitoring system for the budworm, using pheromone-baited traps.

We are especially pleased with this project because it has involved the user groups from the earliest stages of planning. They were involved in designing the system, they are involved in evaluating it, and we expect they will eventually implement it in operational programs. This will be evidence of a really successful technology transfer effort.

One of the successes of the Program has been a project dealing with the utilization and marketing of balsam fir that has been damaged by the spruce budworm. This work was done in the Lake States, and it has applicability to the entire spruce-fir region.

The study focused on two potential sources of balsam fir. The first is mature balsam fir. It is generally agreed that underutilization of this type of fir maintains the forest in a susceptible condition. An increase in utilization of mature fir stands should bring some relief and provide economic benefits. The second source is balsam fir already damaged by the budworm. Its use would not only extend the resource but also have some beneficial effects through better management techniques.

Balsam fir has the potential for increased use for dimension lumber. Its light color, straight grain, and small, tight knots contribute to its suitability for this purpose. What is not generally recognized is the strength of the species. Balsam fir strength values for light framing and studs are superior or equal to many northern pine and eastern spruce species groups for most characteristics, according to the Northeastern Hardwood and Pine Manufacturing Association.

Sawmill yield studies of healthy and budworm-killed fir dead for 1 year showed that balsam fir can produce a relatively high percentage of high-quality dimension lumber grades of Standard and Better and Number 2 and Better. However, large percentages of Utility and lower grades sawn from the dead timber confirm that balsam fir under attack by budworm should be harvested before or soon after death if it is to be used for dimension lumber production.

This project also examined the suitability of healthy and dead fir for the manufacture of composite panel products. Balsam fir has the desirable characteristics of low density, high compressibility and good glueability, which make it an excellent candidate for composite panel products.

Both waferboard and ring flakeboard can be made from healthy and budworm-killed fir dead up to 2 years before harvesting. In addition, it was found that various amounts of balsam fir material can be mixed with an aspen furnish to produce an aspen/balsam fir composite panel.

Testing of these products showed that healthy and budworm-killed balsam fir waferboard yielded strength properties above the minimums required in the U.S. Commercial Standard for type 2BC particleboard. Harvested material from this study showed a decrease in chip quality and an increase in the amount of fines produced during the waferizing of dead balsam fir, but these problems can be overcome by increasing the moisture content of the dead material before waferizing.

Another part of this work examined the kraft and thermomechanical pulping (TMP) processes on healthy balsam fir trees and trees dead for periods up to 2 years. The TMP pulps produced from healthy and dead balsam fir showed similar strength properties. Wood deterioration that occurs in the upper bole as a result of budworm damage does not have a significant effect on the total pulping process.

Another major endeavor of the Program has been to improve the acceptability of *Bacillus thuringiensis* (B.t.) for forest protection. Managers have been hesitant to accept B.t. because of the varying results that have been obtained over the years. Several formulations and dosages have been used under a wide range of conditions, evaluated by different methods and not surprisingly, have yielded inconsistent results. The international scope of the CANUSA Program provided an opportunity to evaluate B.t. on a regional scale with uniform work plans that would yield general conclusions regarding the effectiveness of B.t. treatments. Tests were conducted in several locations with varying budworm population and host mixtures. Data were analyzed at a central location and results distributed. The fact that more and more B.t. is being used in operational budworm control programs indicates that State and Provincial agencies have found B.t. to be a useful control material.

Besides these activities, the following would not have been accomplished without Program support:

1. Two new strains of B.t. that are more virulent in laboratory tests than the current commercial strains have been isolated and made available to the biological insecticide industry. We understand that field tests are planned this year with commercial preparations of the new strains to determine if this increased activity is present in operational situations.

2. Investigators have been successful in adopting 35 mm aerial photographs for risk rating of spruce-budworm-infested stands. A comprehensive training manual is available, and several training sessions have been held.

3. Targeted harvesting and spraying methods have been developed to eliminate or decrease the budworm-infested area needing treatment. In this process, the forest manager targets his harvesting and treatment

planning and operations to stands that are the most valuable and contain significant amounts of spruce and fir. Through this type of planning and scheduling, marginal spruce-fir stands and mixed wood stands are eliminated or deferred from harvesting or spraying in favor of the more valuable stands.

4. Chemical encapsulation methods have been used to produce chemical and B.t. spray droplets of a uniform size. Proper droplet sizing produces a more efficient spray deposition and results in better contact or ingestion by the insect.

In both CANUSA-East and CANUSA-West we have mounted a sustained publication effort aimed at providing forest managers, pest managers, researchers, and the public with comprehensive,up-to-date information on all aspects of dealing with the spruce budworms. In addition to hundreds of scientific and technical articles, we have approved more than 40 special USDA publications. In the East the centerpiece is *A User's Guide for Managing Spruce Budworm in Eastern North America*. This publication consolidates all available information on budworm management and control. It brings together new information as well as older information based on experience and practice in a form most useful to managers. There is also a series of 16 state-of-the-art booklets or "user handbooks," on subjects ranging from techniques for monitoring aquatic systems for pesticides to guidelines for hazard rating Lake States forests.

The ultimate success of CANUSA will be measured in the changes in current practices that have resulted from CANUSA Program efforts. Some of these are emerging already. For instance:

1. State and Provincial pest control agencies are using more B.t. each year.

2. Pest and forest managers are using the concept of targeted harvesting and spraying to reduce the area needing treatment. This practice results in cost saving and lessens environmental contamination concerns.

3. Use of the Green Wood wood supply model permits forest managers in Maine to forecast wood losses due to the budworm and to consider options.

4. Use of 35 mm aerial photography for spruce budworm hazard rating provides forest managers in Maine and the Lake States with a tool for risk rating individual stands and scheduling harvest or control activities.

In summary, the accomplishments of the CANUSA Program are in line with Program objectives. The success of the Program will be determined, however, by the extent to which Program products are put into use.

Melvin E. McKnight — Program Leader
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Robert L. Talerico — Research Coordinator
CANUSA-East
Broomall, Pa.

Green Wood Model Workshop

Forty-three people attended the opening session, March 15, of a 2-day CANUSA/University of Maine-sponsored workshop on use of the Green Wood Model. The model is the product of the Green Wood demonstration project, a cooperative undertaking in Maine promoted by the CANUSA Program. The workshop, organized by Gordon Mott, Robert Seymour, and John Dimond, served three purposes. It (1) provided participants with understanding of how the model was originally constructed and subsequently evolved; (2) provided attendees with "hands on" experience in using the model; and (3) generated feedback for revising the draft *Users' Handbook* for model application. Publication of the handbook is expected in late 1983.

The Green Wood Model is a large-acreage forest inventory simulator. Starting with current inventory, the user can project the latter, subject to user-specified growth rate, harvest schedules, loss rates (budworm), and protection levels. The model does not optimize harvest and/or protection policies. It does allow the operator to compare inventory projections for various imposed scenarios. The run time for a scenario is short.

The second day was the "working" part of the workshop. Although Bob Seymour (UMO) and Dave Edson and Peter Triandafillou (Sewall Company) were available to answer questions, the user-computer interaction was distinctly friendly as well. Attendees learned that preassembling data on prepared worksheets speeds data input. However, the computer

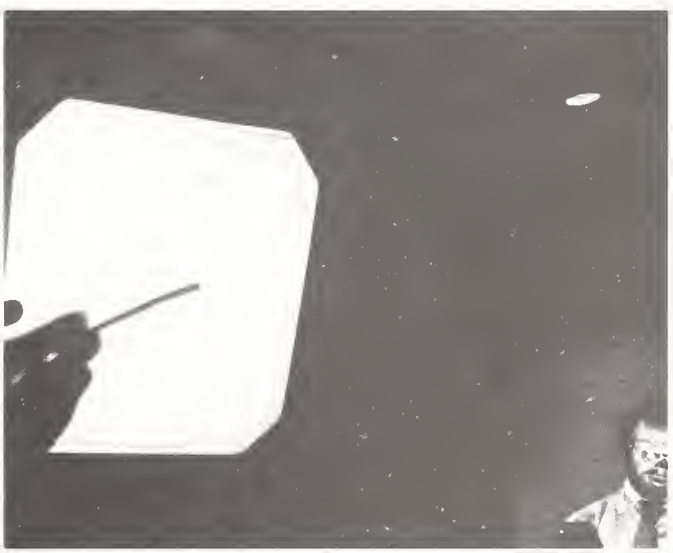

Figure 1. – Dan Schmitt took his spooky shot of Bob Seymour pointing out features on a graph during his talk on the Green Wood model.

Figure 2.– During the workshop, Peter Triandafillou (standing) comments on the terminal display.

prompts are so detailed and explicit that disorganized novices can run any of their data without assistance if they remember to bring them.

Although workshop attendance had to be limited to provide substantial online experience for each participant, there appears to be no substitute for the ''working'' workshop with user problems, user data, and user ''what if's'' to stimulate creative application of a new generation of forest management tools. The workshop organizers and CANUSA-East Program Management thank the University of Maine for allowing use of their computer terminals and facilities.

Dan Schmitt — Program Manager
CANUSA-East,
Broomall, Pa.

Budworm Workshop for Michiganders

How important is the spruce-fir resource in northern Lower Michigan? Sixty forest managers and landowners met at Gaylord, Michigan, to discuss this and other related topics. CANUSA-East and Michigan's Cooperative Forest Pest Management Program presented the workshop, ''Spruce Budworm Management in Northern Lower Michigan,'' on March 16.

First on the agenda was a panel discussion of ''Why manage spruce-fir in northern Lower Michigan?'' Ronald Murray, forest pest specialist with the Michigan Department of Natural Resources (DNR), was largely responsible for organizing the workshop and served as panel moderator. Panel members included the DNR State forester, a private industrial land manager, a forest economics professor, and the timber and wildlife management staff officer from the Huron-Mainstee National Forest. Each panel member discussed the relative importance of the spruce-fir resource in the northern Lower Michigan economy — past, present, and future.

For the most part the panel agreed that regionally (northern Lower Michigan), spruce-fir does not account for a significant proportion of the forest inventory and is only ''moderately'' important. Likewise, markets for spruce and fir timber have been poor in the past, are poor today, and appear poor for the future. However, the owners of woodlands with a high proportion of spruce and fir trees are concerned about spruce-fir and by extension, about spruce bud-

worm. Incidentally, northern Lower Michigan's spruce-fir stands were devastated by the spruce budworm in the mid-1970's. The perceived importance of this resource may increase as the spruce-fir regeneration matures.

After a short coffee break, during which Ron Murray was interviewed by the local television people, the group viewed a videotape on spruce-fir silviculture. The tape had been produced by the CANUSA-funded Spruce Budworm Technology Transfer Program for the Lake States. It gives a nice overview of the spruce budworm's biology and impact, and management alternatives in the Lake States. Comments and suggestions from the audience will be used in the final revision of the tape. The workshop participants would like to see more tapes produced, particularly ones for the general public. We'll work on it.

In the afternoon, the foresters were finally released from the confines of the conference room and bussed out to the field. At the first stop, Gary Simmons, Michigan State University's forest entomology professor, stimulated the best discussion of the day by asking the participants how they have managed, or would manage, spruce-fir stands. Gary's question really seemed to get the group thinking about preparing for the next spruce budworm outbreak. Several participants will now use compartment reviews and stand inventories to keep track of high-risk conditions.

At the next stop, the workshop focused on how to decide which stands to cut, protect, or abandon. The group found out how to rank stands according to estimated mortality from potential spruce budworm outbreaks. Specific factors that increase the risk of volume loss and tree mortality were listed. Discussions also included what treatment alternatives are available and how they can be economically evaluated.

Overall, the group took several things home besides *The Spruce Budworm Handbook: A Management Guide for Spruce-fir Stands in the Lake States* and other technical reports. The workshop also reinforced several ideas: activities can be implemented between outbreaks to dampen spruce budworm impact, markets are needed for spruce-fir in this region, and the spruce budworm is an important problem to some northern Lower Michigan landowners.

Historically, the spruce budworm has been a much greater problem in the Upper Peninsula of Michigan. A 1-day field trip/workshop, concentrating on silvicultural techniques and hazard rating, is being planned for July or August. It will be held in and around the Camp Filibert Roth area, near Iron River, Michigan. A 1-day workshop similar to the one held in Gaylord has been planned for the Upper Peninsula during the Fall of 1983. Several additional field trips and workshops will probably be developed in 1984 in Wisconsin and Minnesota.

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Joint Registration of Matacil® Flowable

Note: This article appeared in the *Forest Pest Management Institute Newsletter*, volume 1, number 4, December 1982.

Matacil® 180 Flowable, the new aminocarb formulation developed by Chemagro Ltd. of Canada and Mobay Chemical Corp. (USA), has now received its Canadian label. The registration number of this product is 17,418. This material has also been registered in the United States under EPA registration number 3125–327. The registration of this material in both Canada and the United States meets one of the goals of the CANUSA Program: the development of improved formulations of already registered insecticides with registration taking place in each country.

The registration of this new formulation gives the forest manager greater latitude in the selection of environmentally acceptable, efficacious insecticides because Matacil® can now be applied as either a water or oil suspension. The testing of this product showed that reformulation has greatly reduced the acute toxicity to fish of both the formulated material and the tank mix without any apparent increase in toxicity to other organisms.

J. A. Armstrong — Program Manager
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Sault Ste. Marie, Ont.

An Assessment of Aerial Application Technology

During 1982, National Forest and Ranger District personnel responded to a questionnaire asking them to express their needs and concerns about aerial application technology. Jack Barry, of Forest Pest Management (FPM), conducted the assessment to identify progress and needs for safe and efficient aerial application of pesticides. The assessment was requested by Jim Stewart, FPM director and member of CANUSA's Joint Planning Unit, to determine whether the Forest Service is effectively using aerial application technology, to establish what can be done to increase the use of technology, and to identify the most significant knowledge gaps affecting safe and efficient aerial application.

A brief summary of responses from the field is as follows:

1. *Contracting for aerial application*. Respondees expressed a need for standardized aerial application contracts, and they preferred full-service contracts.

2. *Training*. Respondees would like training in contract management, contract specification, spray drift management, and selection and handling of pesticides.

Figure 3. – Wake characteristics are evaluated by recording smoke behavior after an aircraft passes a meteorological tower.

3. *Weather*. Weather information should be collected and recorded for operational control and project records. A reliable portable weather monitoring and recording station is needed.

The assessment concluded that the Forest Service needs to improve its technology transfer efforts to keep field personnel up to date on how to conduct safe, efficient spray operations. Significant progress has been made in advancing aerial application since the 1979 Forest Service study *Problem Analysis — Forest and Range Aerial Pesticide Application Technology.*

No reorganization of Forest Service activities was recommended; however, the assessment suggested that the Chief establish program objectives, work priorities, budgets, and manpower as recommended by specialists in pesticide use and management to advance technology implementation. There were several recommendations on improving management of aerial spray projects, including training, publication of handbooks, use of weather instruments, incorporation of drift control methods, and expanding use of the Cramer-Barry-Grimm (CBG) forest spray model.

An action plan to implement the recommendations is being prepared by FPM.

Copies of the complete document — *An Assessment of Aerial Application Technology* — are available from John Barry, USDA Forest Service, Forest Pest Management, 2810 Chiles Rd., Davis, CA 95616.

CANUSA Environmental Impact Working Group Meeting

The Environmental Impact Working Group met in conjunction with the Eastern Spruce Budworm Research Work Conference on January 11, 1983 at Bangor, Maine, under the leadership of cochairpersons Joan G. Trial and Peter Kingsbury. The theme of the meeting was ''Environmental Monitoring: Does It Influence Spruce Budworm Management?'' Representatives from Maine, New Brunswick, Quebec, Ontario, and Canadian and U.S. Federal agencies were asked to address the following questions in both current and historical development contexts:

1. Who funds monitoring and how does the amount funded compare to the total cost of the budworm control operation?

2. Who decides what monitoring should be done and what are the criteria for these decisions?

3. Does the information from monitoring get incorporated and implemented into control policies and spray program planning? If so, how?

Some of the facts and ideas presented follow:

Maine

John Dimond, Entomology Department, UMO, gave an account of environmental monitoring associated with spray programs between 1954 and 1970. The extent and scope of monitoring associated with the early spray programs were limited, partly because the programs were small and geographically isolated, and because of a belief that the observed effects of DDT, though dramatic at times, could not result in significant lasting effects. Funding came from the Maine Forest Service and the Conservation Foundation. Public outcry building from the publication of the book ''Silent Spring'' in 1962, and responsive to the first extensive media attention to the budworm spray program of 1967, precipitated involvement of a number of Federal and State agencies in monitoring studies. Initially, there was little coordination of

Figure 4. – NASA cooperators work with FPM in evaluating aircraft wake characteristics, which influence deposition of spray drops.

monitoring efforts, but by 1970 monitoring requirements had been incorporated into funding of spray programs. Until then, monitoring had little effect on spray policy or program planning.

Steve Oliveri, Maine Forest Service, discussed the funding and planning of monitoring programs from 1970 to the present. From 1970 to 1976 all monitoring done in Maine was funded by the USDA Forest Service. In 1977 the cost of monitoring was included in the operational costs of each year's spray program, and since then monitoring costs have averaged 1.6 percent of project costs, or $109,000/yr. An Environmental Monitoring Committee, organized in 1977, recommends specific projects and advises the Maine Forest Service about scope and direction of monitoring efforts. This input is discussed by the Forest Insect Manager and the Director of Forestry, and their staffs, who then make the decision on what projects will be undertaken. Under the supervision of an Environmental Research Coordinator at the Maine Forest Service, bids are invited and a contractor is selected to do the studies. Steve noted that the results of monitoring efforts in Maine have been incorporated into policy decisions, including increased B.t. usage, spray buffer policies for lakes and streams, and rejection of the concept of leaving unsprayed refuge areas in the headwaters of streams as an operational

option. The current organization of the monitoring effort has built up a group of interested researchers and a large base of environmental information on the effects of chemicals currently in use. The Maine Forest Service intends to shift from short-term impact monitoring and methodology development to environmental monitoring of designated spruce-fir stands on an annual basis for a long-term perspective of impacts.

New Brunswick

Frank Webb, of Forest Protection Limited, presented some thoughts on environmental monitoring activities pertaining to spruce budworm control programs in New Brunswick in the 1950's, 1960's, and 1970's. He felt that in general, arrangements for monitoring fitted the times when they were set up, and the changes that have occurred in the conduct and organization of environmental monitoring reflected alterations that are common to all spray program decisionmaking and regulatory bureaucracies. He suggested that although it was clear that environmental monitoring had influenced spruce budworm spray programs, the issue was much more in doubt as to whether environmental monitoring had influenced spruce budworm management. He pointed out that many opportunities for studying the effects of spraying with chemical insecticides had been pursued, but there has been little initiative taken to document the effects of decisions not to use chemical insecticides. He noted the long involvement of Forest Protection Limited in environmental monitoring, not only as a funding agency but also as a proponent and initiator. For the years 1978–79 Forest Protection Limited funded the operations of the EMOFICO committee (Environmental Monitoring of Forest Insect Control Operations) and most of the projects undertaken within that committee. The costs involved over those 2 years represented about 8 percent of the total spray program costs.

Since 1980 the EMOFICO committee has been chaired by the New Brunswick Department of Environment, who provide a secretary to the committee and have annually funded about $50,000 in environmental work. Ken Browne of that Department cited the usefulness of information generated for setting policies regulating conduct of the spray program, or for helping decisions to be made on future projects, as the main criterion for deciding what monitoring is funded. A committee within the New Brunswick Department of Environment makes the decisions on which proposals are funded. The results of all environmental monitoring programs carried out are integrated into reports of the EMOFICO committee, including studies funded completely by other agencies. The information generated has influenced spray program planning through impact on registration matters and the terms or conditions the New Brunswick Department of Environment attaches to spray program permits.

Quebec

Peter Kingsbury, representing Gilles Gaboury of the Quebec Ministry of Energy and Resources, outlined the approaches to environmental monitoring associated with spray programs in Quebec. Shortly after the initiation of spray programs in the early 1970's, a Committee for Environmental Surveillance of Aerial Sprays was set up at the request of the Provincial spray agency. Membership of the Committee included Federal, Provincial, university, and health sciences representatives. Its purpose was not to make decisions on what, where, or how spraying would be done, but to assure that adequate measures would be taken to study effects of the programs conducted on the environment. A subcommittee, consisting of research staff from Federal and Provincial agencies, was set up to organize and conduct a surveillance program designed to detect major short term changes in animal populations within sprayed areas, and to identify impacts which might occur as the result of spray "accidents," such as navigational errors, equipment failures, formulation errors, or emergency dumps. The objective of the monitoring effort was to evaluate the effects of the total spray program by covering the greatest possible area of sprayed territory with the available resources. This type of monitoring consisted primarily of pre- and postspray population censuses of songbirds, small mammals and aquatic invertebrates, coupled with insecticide residue surveys. The funding for this monitoring network came from the Provincial spray agency. Other agencies tended to conduct studies more limited in their geographic scope oriented more to impact assessment methodology.

Eventually, because of a decrease in participation by other agencies, the Provincial spray agency limited its monitoring network to an annual insecticide residue survey, evaluating residues in foliage, litter, soil, water, and sediment in as much of the sprayed area as possible. This work was supplemented by contract research, set up and funded by the Provincial spray agency, designed to study effects under controlled lab or field conditions of measured insecticide residues so that some interpretation of potential effects could be extrapolated from the residue survey.

The current (1983) situation in Quebec will be changed as new Provincial legislation is implemented, empowering the Quebec Environmental Protection Service with assessment, licencing, and regulation of the Provincial spruce budworm spray program.

Ontario

Steve Nicholson, of the Ontario Ministry of Natural Resources Pest Control Section, outlined environmental monitoring programs and policies put into place in Ontario since 1979. Environmental moni-

toring programs representing about 30 percent of total program costs were built into modest-sized spray programs in 1979–80 and contracted to consultants. In the light of experience from these programs and the large amount of information available from other areas with far larger programs, major environmental monitoring efforts will not be incorporated into future programs unless specific local concerns or data gaps are identified. Regional wildlife and parks personnel will have to identify significant local values that require protection from spraying in areas where forestry personnel have identified timber values requiring protection by spraying. If the necessary environmental monitoring is defined to ensure these local values are protected, it will have to be conducted and/or funded by internal resources in the region. Attempts to set up an interdisciplinary committee to set environmental policy guidelines have stalled because of an apparent lack of interest.

Federal Role-U.S.

Dave Grimble, of CANUSA-East, reported that environmental monitoring proposals received as a result of the 1978–81 research funding proposals were processed in the same manner as all other proposals and that the projects funded related to the impacts of Matacil®. Environmental monitoring was not considered one of CANUSA-East's highest priorities and thus few projects were funded. CANUSA-East did contract for an environmental monitoring information manual on methodologies for aquatic monitoring and this manual will be available soon.

Dan Kucera explained that the State and Private Forestry group of USDA Forest Service is responsible for preparation of environmental impact assessments and environmental impact statements, and has been involved in funding environmental monitoring. From 1970 to 1976 State and Private Forestry funded monitoring studies in Maine, primarily on chemicals new to forestry use. Monitoring is now an integral part of the operational costs for all spruce budworm control programs in the Northeast region. It serves to substantiate the predicted impacts in environmental impact statements and to check on the effectiveness of operational options to reduce environmental impacts.

Federal Role-Canada

Peter Kingsbury, speaking about the federal role in Canada, reported that agencies within Environment Canada are under direction not to engage in monitoring of Provincial programs, but do have varying levels of involvement in environmental research related to spraying, depending upon each agency's and regional branch's assessment of the importance of this area of research. Federal involvement in insecticide testing and registration is well defined, and several legislative acts give such Federal agencies as the Canadian Wildlife Service, Environmental Protection Service, and Department of Fisheries and Oceans responsibilities and powers for ensuring protection of various portions of environments possibly affected by spray programs. Considerable "monitoring" activity is conducted in carrying out these roles.

Representatives from Nova Scotia and Newfoundland were unable to attend the meeting.

In the discussion that followed, three concerns were expressed:

1. Most of the environmental monitoring programs in place cannot adequately address potential cumulative effects of annual spray programs.

2. There is a tendency within the research community to become involved in basic ecological studies in the context of short-term spray impact projects, and there is less emphasis on economically important species. The environmental monitoring funding agencies present pointed out that they prefer to fund "need to know" rather than "nice to know" studies, but fewer proposals addressing management-oriented questions were being submitted.

3. Researchers show little sustained interest in attempting to record the cumulative effects of spraying.

The next focus of environmental monitoring programs should be to look at spruce budworm spraying in the context of overall management of the forest, putting emphasis on evaluating impacts of habitat changes resulting from natural and human causes.

Peter Kingsbury — Forest Pest Management Institute
Canadian Forestry Service
Sault Ste. Marie, Ont.

Annual Meeting of the CFS Implementation Team

For those of you who cannot recall, or were not on the scene when the CANUSA Program began, the CFS agreed, in bringing its base program into the agreement, that it would revamp and streamline its research program and make the research more relevant to the needs of the resource managers. To that end Chris Sanders, Great Lakes Forest Research Centre, led a task force to review CFS budworm programs, to assess their relevance, status and achievability, and to recommend changes in keeping with today's needs. The report was presented to the CFS Board of Directors in a Toronto meeting in May 1980. The Board of Directors accepted most of the task force report and commissioned an Implementation Team, consisting of regional centre, institute, and headquarters managers, to put the accepted recommendations into effect. This team prepared a critical path plan to address the Program, and now meets annually to track progress.

This year the team met March 1–3 at CFS headquarters. In attendance were John Hudak, Newfoundland Forest Research Centre; Graham Page, Maritimes Forest Research Centre; André Lavallée, Laurentian Forest Research Centre; Cal Sullivan, Lloyd Sippell, and Chris Sanders from Great Lakes Forest Research Centre; Terry Ennis and Jack Armstrong, Forest Pest Management Institute; and from CFS headquarters, Tom Sterner, Bob Taylor (recording secretary) and Chuck Buckner (Chairman). Two activity leaders, Jack Basham and Barry Helson, elected to present their reports in person. The remainder reported through the responsible centre managers.

By and large, the Program is on target and outputs will be available as promised. Activity A dealing mostly with short-term impacts, Activity B dealing with product quality and utilization, and Activity C assessing fire risk, because of their discrete and easily targeted objectives, are nearest to completion. Some of this work has already been transferred as technology for use by resource managers and other users, and much will terminate concurrently with the CANUSA agreement. There are, however, commitments to maintain the long-term aspects of certain problem areas, especially those that have a multiactivity area interface. Don Ostaff, leader for Activity A, Short-term Impact, expressed concern about the slow progress in providing additional expertise in the remote sensing program to deal with rapid detection and appraisal. The Implementation Team reiterated their concern to senior management that immediate action is needed in this area.

Wilf Cuff, leader of Activity D, Management Strategies, reported some progress in achieving the outputs contained in this section, but recommended that the Activity be split. Those aspects dealing with Population Dynamics were considered discrete enough to warrant independent status. Hence the Implementation Team established a new Activity J, Population Dynamics, under the interim leadership of Chris Sanders to address this area of investigation.

Lloyd Sippell and Cal Sullivan introduced progress reports for Activities B, Product Quality, and C, Fire Risk. Jack Basham elaborated upon the Product Quality area, indicating that by the end of the Program, or shortly thereafter, the full package would be in the hands of industry. Particular emphasis has been placed upon pulping qualities, using the three major industrial processes. Brian Stocks has completed the bulk of his fire-risk work, which indicates that budworm-decadent stands are a major fire risk in spring before the growth of ground cover.

Jack Armstrong and Terry Ennis assisted in presenting the reports on control materials and associated environmental impact work. Jack expressed concern again about the lack of new materials being developed by industry, which has slowed the expected registration of new compounds anticipated at the beginning of the Program. Several biologicals are now in the registration process, some for use as test cases on insects other than budworm. Jack commented on the lack of CFS expertise in the field of impacts on terrestrial invertebrates, an area stressed as of prime importance in the task force report.

The group also spent some time on the CANUSA related activities: Symposium and Bibliography. Both are high CFS budworm priorities, and the managers are anxious to see good results. Chris Sanders will work with Ron Stark on the CANUSA Symposium, and the wish to see the Bibliography project continue has been communicated to Mel McKnight.

August Utilization Conference

Dan Schmitt has announced the program for the CANUSA-East/University of Maine meeting on the utilization of budworm-killed spruce and fir, to be held August 17–19 in Bangor, Maine.

Conference Title: From Stump Through Mill — Recent Advances in Spruce-Fir Utilization Technology

Wednesday Afternoon, August 17, 1983

Harvest/Transport/Storage Session — Chaired by Ben Hoffman, Forestry Division, UMO

Thememaker: The Harvest — A Challenge and an Opportunity

Prof. Colin Sewall, Faculty of Forestry
Laval University
Quebec, P.Q.

Topic: Spruce/Fir Supply and Demand

Dave Edson
J. Sewall Company
Old Town, Me.

Topic: Pathological Considerations in Harvesting, Transporting, Storing and Marketing

Anthony Binotto
Great Northern Paper Company
Millinocket, Me.

Topic: Harvesting Methods and Systems — Logging and Off-Highway Transport

Prof. Thomas Bjerkelund, Faculty of Forestry
University of New Brunswick
Fredericton, N.B.

Topic: Transportation — Rail, Truck, Ship — of Chips and Roundwood and Problems with Export Markets

Michael Cyr
Seven Islands Land Company
Bangor, Me.

Topic: Storage — Problems in Handling and Storage, Chips and Roundwood

Windsor Kelly
Nova Scotia Forest Industries
Woodlands Department
Port Hawkesbury, N.S.

Evening ice breaker

Thursday Morning, August 18, 1983

Energy Session — Chaired by Norm Smith, Agriculture Engineering Department, UMO

Thememaker: The Combustion of Wood

Richard Hill
Dept. of Mechanical Engineering
University of Maine
Orono, Me.

Topic: Industrial Wood Energy Systems

Roger B. Bloomfield, Jr., President
New England Steam Engineering
Portland, Me.

Topic: S.D. Warren Biomass Energy Project

William E. Van Voorhis, Chief Engineer
S.D. Warren Company
Westbrook, Me.

Topic: Great Northern Paper Company's Bark Boiler

Paul I. Firlotte
Manager, Power Systems
Great Northern Paper Company
Millinocket, Me.

Topic: Suspension Burning of Pelletized Wood in a Package Boiler

R.S. (''Reg'') Reid, Project Engineer
McCain Foods Limited
Florenceville, N.B.

Topic: Pelletization of Wood Residues

Gilles Bellefeuille, V.P. and General Manager
Bio Shell Inc.
Montreal, P.Q.

Topic: Harvesting for Energy

Hollis A. Hanington, Jr., President
Hanington Brothers
Wytopitlock, Me.

Thursday Afternoon, August 18, 1983

Pulp and Paper Session — Chaired by Joe Genco, Chemical Engineering Department, UMO

Thememaker: Overview on Utilization of Budworm-Infected Spruce and Fir — Emphasis on Kraft Pulping

John V. Hatton
Pulp and Paper Research Institute of Canada
Vancouver, B.C.

Topic: The Effect of Using Budworm-Damaged Wood on Mechanical Pulp Quality and Yield

N. Franks, J. Kramer, and T. Taylor
St. Regis
West Nyack, N.Y.

Topic: Mechanical and Chemimechanical Pulping of Budworm-Killed Balsam Fir for the Manufacture of Newsprint

R.E. Dines and G. Tombler
CIP
Hawkesbury, Ont.

Topic: Utilization of Budworm-Killed Balsam Fir in Thermomechanical Pulping

Donald Manchester, et al.
Abitibi Price
Mississauga, Ont.

Topic: Utilization of Budworm-Killed Spruce and Fir in Sulfite Processing — A Laboratory Scale Investigation

Anthony Binotto
Great Northern Paper Co.
Millinocket, Me.

Topic: Utilization of Budworm-Killed Spruce and Fir in Full Scale Sulfite Processing

Ralph Keef
Nova Scotia Forest Industries
St. Johns, N.S.

Banquet, speaker to be announced

Friday Morning, August 19, 1983

Wood Products Session — Chaired by Jim Shottafer, Forest Products Laboratory, UMO

Thememaker: Spruce-Fir in Use

Thomas C. Marcin
USDA Forest Products Laboratory
Madison, Wisc.

Topic: Lumber Yield and Recovery from Spruce and Fir

Steven A. Sinclair
Department of Forest Products
Virginia Polytechnic Institute & State University
Blacksburg, Va.

Topic: Strength Characteristics of Spruce and Fir

David W. Green
USDA Forest Products Laboratory
Madison, Wisc.

Topic: Drying of Spruce and Fir

John R. Noffsinger
St. Regis Paper Company
Jacksonville, Fla.

Topic: Structural Board Products from Spruce and Fir

Roland O. Gertjenjansen
Department of Forest Products
College of Forestry
University of Minnesota
St. Paul, Minn.

Topic: The Relationship Between Better Trees and Better Products, in Spruce and Fir

Alex L. Shigo
Forestry Sciences Laboratory
USDA Forest Service
Durham, N.H.

Change in JPU Membership

Les Carlson, recently appointed Director of Research and Technical Services, Canadian Forestry Service Headquarters, will assume a position on the Joint Planning Unit, replacing Tom Sterner, who served in this capacity following the transfer of Ross Macdonald to PFRC, Victoria, B.C. Les brings to the JPU experience in pathology and silviculture, areas of particular concern in the closing years of the Program. Tom will continue as a member *ex officio* to the end of the Program.

Personnel

Grant Davidson Retires

A.G. ''Grant'' Davidson hung up his spurs in January after a meritorious 35-year career with the Canadian Forestry Service. Grant began his career at the Maritimes Forest Research Centre in Fredericton, N.B. as a research scientist specializing in forest pathology. Later he moved to Ottawa, where he became senior research advisor in entomology and pathology for the Forest Insect and Disease Survey. The watchword in Headquarters for many years has been, ''If Grant doesn't know the answer already, he'll find it!'' His wealth of knowledge will be sorely missed in the Ottawa office.

He was no stranger to the budworms nor to the CANUSA Program. His accurate appraisals of the status of the beasts have been recorded in the FIDS reports, the *Newsletters*, and in scientific publications. Many know him best as the convenor of the ''FORUM,'' where his presence over the past 10 years has kept the program moving and the proceedings in print. His attention to detail, an attribute that few possess, will be difficult to replace, and his dry humor will be missed by his Headquarters colleagues. It is hoped that contractual arrangements will keep him available in the CFS for some time yet. Meanwhile, Grant, you are missed by your ''budworm buddies.''

Taylor Succeeds Davidson

Bob Taylor, Executive Assistant to the Canadian Program leader Chuck Buckner, is leaving the CANUSA fold to assume the duties vacated by Grant Davidson. Although Grant has departed with a formidable image, Bob, we are sure, will be fighting to maintain the high standards set by Grant. Bob has demonstrated, in his short tenure at CFS Headquarters, that he will be equal to the task, and all the questions formerly directed towards Grant will surely be adequately fielded by Bob.

Bob will not completely abandon the CANUSA Program. He has several vested interests that will keep him occupied, including his involvement in the Inventory and his responsibilities to the 1984 Budworm Symposium. And Chuck will still be able to call on his considerable expertise in the registration of pesticides process — after all, he'll just be ''down the hall.''

CANUSA will not be saying good-by, Bob, just congratulations on your new appointment, thanks for your considerable contribution to the CANUSA Program, and for your help in the waning years of CANUSA.

Tom Sterner Moves to PFRC

Tom Sterner has been appointed Manager, Forest Protection – Research and Services, Pacific Forest Research Centre, Victoria, B.C., replacing Doug Miller, who recently retired after 35 years service with the Federal government in agriculture and forestry. Tom is responsible for managing and directing research projects involving bark and wood-boring insects, defoliating insects, root and stem decays, pest impacts, losses in regeneration and the development of biological controls of forest pests.

Tom joined the Canadian Forestry Service in 1966 at the Maritimes Forest Research Centre in Fredericton, N.B., working in forest pathology research and forest insect and disease survey. He moved to CFS Headquarters in 1977, where he was National Director of the Forest Insect and Disease Survey program until his recent appointment. Tom is a member of the management team for the Canada-U.S.A. Spruce Budworms Research Agreement and Secretary of the Federal Plant Quarantine Advisory Board.

Retirement of Doug Miller

After 35 years of service with Agriculture Canada and more recently with CFS, Doug Miller, Program Manager – Protection, at the Pacific Forest Research Centre, Victoria, B.C., retired in January 1983. Doug played a very important role in coordinating the CANUSA Program elements at PFRC with those administered from the Portland, Oregon, unit. He was an active contributor at the annual program management meetings, until the most recent one in October 1982, when ill health prevented him from attending. Doug's thoughtful and challenging opinions will be missed, not only by the CANUSA Management Team, but also by his friends and colleagues in B.C.

Item from the Press

The spruce budworm is continuing to defoliate New Brunswick forests despite the heavy application of aerial insecticides by the province.

In a report issued by E.G. Kettela of the Maritimes Forest Research Centre, defoliation was reported up two per cent from 1981. About 1,387,000 hectares of defoliation were mapped this year, compared to 1,356,000 hectares the previous year.

Of the defoliation, 811,000 hectares were categorized as severe, 391,000 as moderate and 185,000 as light.

Despite the increase in defoliation, the total land defoliated does not approach that recorded in 1975 when the province lost 4,287,000 hectares to the budworm. In 1980, 849,000 hectares were defoliated.

In 1982, the province sprayed insecticide on four million hectares at a cost of $17 million.

(Daily Gleaner — December 4, 1982)
Fredericton, New Brunswick

Recent Publications

From the USDA Forest Service, Intermountain Forest and Range Experiment Station, 507 25th Street, Ogden, UT 84401, you may request copies of

Chrisman, Allen B., George M. Blake, and Raymond C. Shearer. 1983. "Effects of western spruce budworm on Douglas-fir cone production in western Montana." Res. Pap. INT-308. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 7 p.

Forest Pest Management, USDA Forest Service, 2810 Chiles Road, Suite B, Davis, CA 95616, announces the availability of their handbook "Pesticide Safety Guide for Personnel Protection." Ask for FPM 83-1.

From the USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, 240 W. Prospect Street, Fort Collins, CO 80526, comes

Schmid, J. M., and P. A. Farrar. 1982. "Distribution of western spruce budworm egg masses on white fir and Douglas-fir." Res. Pap. RM-241. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 7 p.

Dave Grimble noted these publications in his most recent "Dear Colleague" letter. Dave can provide ordering information for the nonjournal articles. Call him at (215) 461-3017 (FTS 489-3017).

Albert, P. J. 1982. "Host plant preferences in larvae of the eastern spruce budworm, *Choristoneura fumiferana*." Proc. 5th Internat. Sympos. Insect Plant Relationships, Wageningen. p. 19–24.

Blais, J. R. 1982. "Rating vulnerability of balsam fir to spruce budworm attack in Quebec." Info. Rep. LAU-X-51. Sainte-Foy, PQ: Laurentian Forest Research Centre. 19 p.

Dimond, J. B. 1982. "Effects of aerial sprays of undiluted *Bacillus thuringiensis* formulations on spruce budworms." Misc. Rep. 274. Orono, ME: Maine Agricultural Experiment Station, University of Maine. 9 p.

Elner, J. K., D. J. Wildish, and D. W. Johnston. 1982. "Carbon-14 assimilation by algal communities of oligotrophic ponds treated with formulated aminocarb." Arch. Environ. Contamin. Toxicol. 11:675-679.

Fowler, G. W., and G. A. Simmons. 1982. "Spruce budworm egg mass density on balsam fir: low to extreme population levels (Lepidoptera: Tortricidae)." Gr. Lakes Entomol. 15(4): 277-286.

Hansen, R. W., and J. B. Dimond. 1982. "The feeding biology of spruce budworm on several hosts with reference to timing of insecticidal sprays." Misc. Rep. 266. Orono, ME: Life Sciences and Agricultural Experiment Station, University of Maine. 19 p.

Lynch, A. M., and J. A. Witter. 1983. "Spruce budworm impact in 1981 on 18 spruce-fir stands in the Iron River and Kenton districts of the Ottawa National Forest." Tech. Rep. 83-3. Ann Arbor, MI: Michigan Cooperative Forest Pest Management Program. 33 p.

Lynch, A. M., and J. A. Witter. 1983. "Spruce budworm impact in 1981 on 25 spruce-fir stands in the Bessemer, Watersmeet, Ontonagon and Bergland districts of the Ottawa National Forest." Tech. Rep. 83-4. Ann Arbor, MI: Michigan Cooperative Forest Pest Management Program. 49 p.

Lynch, A. M., and J. A. Witter. 1983. "Spruce budworm impact in 1981 on 17 spruce-fir stands in the Sault Ste. Marie and St. Ignace districts of the Hiawatha National Forest." Tech. Rep. 83-5. Ann Arbor, MI: Michigan Cooperative Forest Pest Management Program. 33 p.

Lynch, A. M., and J. A. Witter. 1983. "Spruce budworm impact in 1981 on 21 spruce-fir stands in the Munising, Rapid River and Manistique districts of the Hiawatha National Forest." Tech. Rep. 83-6. Ann Arbor, MI: Michigan Cooperative Forest Pest Management Program. 41 p.

Minerowicz, E. A., D. A. Gawvin, M. Kagalwala, M. K. Hill, and J. M. Genco. 1982. "Pulping of budworm-killed balsam fir." Bull. 786. Orono, ME: Life Sciences and Agricultural Experiment Station, University of Maine. 29 p.

Montgomery, B. A., G. A. Simmons, J. A. Witter, and J. L. Flexner. 1982. "The spruce budworm handbook: a management guide for spruce-fir stands in the Lake States." Handbook 82-7. Ann Arbor, MI: Michigan Cooperative Forest Pest Management Program. 35 p.

Simmons, G. A., and G. W. Fowler. 1982. "Spruce budworm egg mass density of balsam fir and white spruce: low population levels (Lepidoptera: Tortricidae)." Gr. Lakes Entomol. 15(4):287-296.

Smirnoff, W. A. 1982. "Instructions for evaluating deposits of *Bacillus thuringiensis* formulas during aerial treatments." LAU-X-54. Sainte-Foy, PQ: Laurentian Forest Research Centre. 6 p.

Smirnoff, W. A., and A. Juneau. 1982. "Physical analysis of the dispersion of *Bacillus thuringiensis* against spruce budworm." LAU-X-55. Sainte-Foy, PQ: Laurentian Forest Research Centre. 18 p.

Tsomides, L., K. E. Gibbs, and D. T. Jennings. 1982. "Species of Odonata feeding on Lepidoptera in spruce/fir forests in Maine." Res. Life. Sci. 30(1). 12 p. (University of Maine, Orono publication.)

From USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, OR 97232, you may request

Daniel B. Twardus and Martha H. Brookes. 1983. "A decision-support system for managing western spruce budworm: report from a workshop. Portland, OR": U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 18 p.

Three publications are available from the Forest Pest Management Institute, Box 490, Sault Ste. Marie, Ont. P6A 5M7.

McLeod, B. B., and R. L. Millikin. 1982. "Environmental impact assessment of experimental spruce budworm adulticide trials. Part 1. Effects on forest avifauna." Information Report FPM-X-54.

Holmes, S. B., and P. D. Kingsbury. 1982. "Comparative effects of three Matacil® field formulations on stream benthos and fish." Information Report FPM-X-55.

Retnakaran, A., G. G. Grant., T. J. Ennis, P. G. Fast, B. M. Arif, D. Tyrrell, and G. G. Wilson. 1982. "Development of environmentally acceptable methods for controlling insect pests of forests." Information Report FPM-X-62.

In the Hopper

Three publications have gone out for typesetting since our last *Newsletter*:

Dave Grimble and Ozzie Morris's "Regional Evaluation of B.t. for Spruce Budworm Control in Maine and Canada"

Dan Jennings, Dave Fellin, Harold Batzer, Mark Houseweart, and Roy Beckwith's "Techniques for Measuring Early-Larval Dispersal of Spruce and Jack Pine Budworms"

Paul Adamus's "Techniques for Monitoring the Environmental Impact of Insecticides on Aquatic Ecosystems"

Bruce Montgomery, John Dimond, John Witter, and Gary Simmons's manuscript on insecticides for control of spruce budworm is presently being reviewed by Washington Office staffs and should be sent for typesetting in April.

We estimate that all four of these manuscripts will be in print by late summer. They are the first of 40 USDA series publications that will carry the CANUSA logo.

To get more information or to have your name added to the mailing list for the *Newsletter*, contact

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